Space Weather Technical Forecast

Issued on Monday, 15 April 2024 at 13:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance G1 day 1 & 3 (15 & 17 Apr). M-flares likely, slight chance of X-flares.

Solar Activity: Moderate with four low level M-class flares in the past 24 hours, three from AR3639 (M1.7 at 15/0118 UTC, M1.0 at 15/0730 UTC & M1.2 at 15/0932 UTC) and one from AR3634 (M2.3 at 15/0842 UTC). There are eleven sunspot regions currently visible on the disk. AR3634 in the northwest is the largest spot on the disk and one of the most complex with a beta-gamma-delta configuration evident. AR3639 is another complex spot with a beta-gamma-delta configuration, and evidence of increasing length and area as it rotates into a less oblique viewing angle. AR3637 in the southeast retains its apparent small delta spot. Recently numbered AR3643 in the southeast continues to emerge around the limb, currently with a beta-gamma configuration. All other spots are smaller and simple.

Two CMEs were observed, the first from a joint C5.0 flare and filament eruption of AR3636 in the southeast disc on 14 Apr. The second is evident leaving the northeastern quadrant of the Sun early 15 Apr, though the exact source region is difficult to determine, further analysis is needed.

Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 displayed a slow regime. Solar wind speeds were slow-ambient, around 330-400 km/s. Density was below average. Interplanetary magnetic field (IMF) strength, Bt, remained weak below 6nT, with the north-south component, Bz, also only varying weakly, between -5nT and +3nT. Phi angle was mostly negative (towards the Sun). Resultant geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at Background. High energy electron flux (greater than 2MeV) observed at GOES16 was Background to Moderate, with a peak of 484pfu observed at 14/1550UTC. The associated 24-hour fluence remained below Active (1e8 integrated flux) with a value of 1.43e7 integrated pfu recorded at 15/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate solar activity is likely, with further M-class flares, these probably originating from spots in the northern hemisphere. There is a slight chance of activity becoming High should any isolated X-class flares occur.

Solar Wind / Geomagnetic Activity: There are up to two CMEs, with the potential for Earth-directed components. The first is from a filament eruption on 12 Apr, which is now late. The second from a joint C5.0 flare and filament eruption on 14 Apr, which may give a glancing blow on 17 Apr. Otherwise, no coronal hole fast winds are expected, with speeds likely background or perhaps slightly elevated.

Geomagnetic activity is expected to be generally Quiet to Unsettled through the 4 day period. There remains a chance of Active or G1/Minor storm periods on day 1 (15 Apr) and on day 3 (17 Apr) from low confidence CME arrivals.

Energetic Particles / Solar Radiation: High energy proton flux as observed by GOES18 is expected to persist at Background. High energy electron flux as observed by GOES-16 is expected to remain at background to moderate levels. The associated 24 hr electron fluence is

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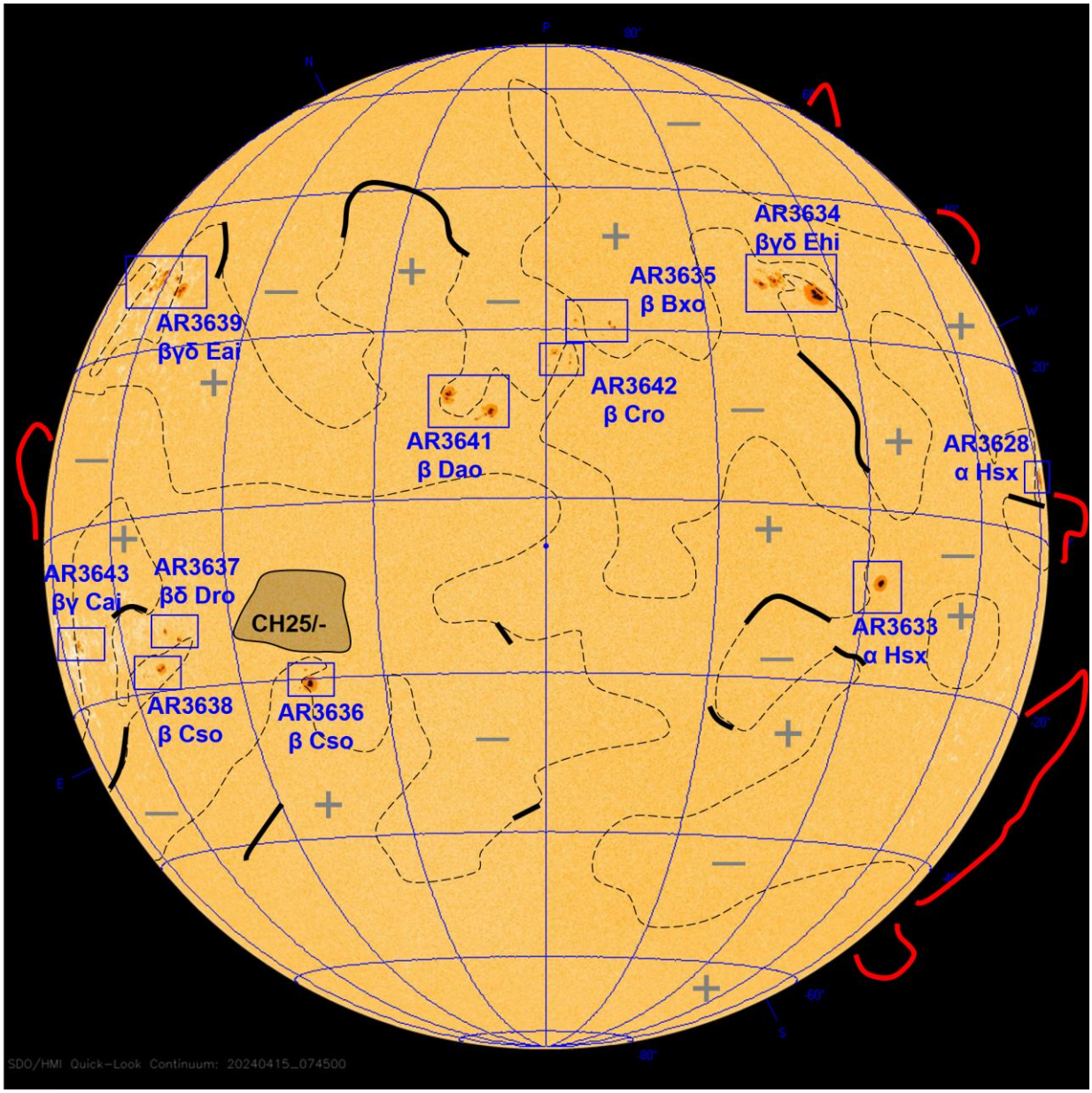
expected to remain below the Active (1e8 integrated pfu) threshold.

Figure 1. Solar Analysis Valid 15/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are up to two CMEs, with the potential for Earth-directed components.

The first is from a filament eruption observed just southwest of centre-disc around 12/0020UTC. The subsequent CME is very faint, but perceptible as a full halo on SOHO C2 and STEREO A difference imagery. This was forecast to arrive early day 1 (15 Apr) but is now considered late with little indication of an imminent arrival. Confidence was high for this CME to be Earth-directed, though confidence is much lower for the strength of any arrival due to its faint nature.

The second was from a joint C5.0 flare and filament eruption of AR3636 in the southeast disc on 14 Apr. Analysis has returned a potential glancing blow at Earth, most likely on day 3 (17 Apr).

There is also a CME which left the northeastern quadrant of the Sun early 15 Apr, though the source region is difficult to determine and further analysis is needed.

No coronal hole fast winds are expected through the period, with the HSS of CH24/- now considered a non-event.

Geomagnetic activity is expected to be generally Quiet to Unsettled through the 4 day period. There remains a chance of Active or G1/Minor storm periods on day 1 (15 Apr) and on day 3 (17 Apr) from low confidence CME arrivals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	5	30	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
11/0856	Partial	Filament	SE	856 km/s	14/2100 UTC -4/+8 hrs	Direct hit still possible
14/1553	Partial	C5 flare + Filament	SE	680 km/s	17/0900 UTC +/-6 hrs	Glancing impact

Figure 2: MOSWOC ENLIL

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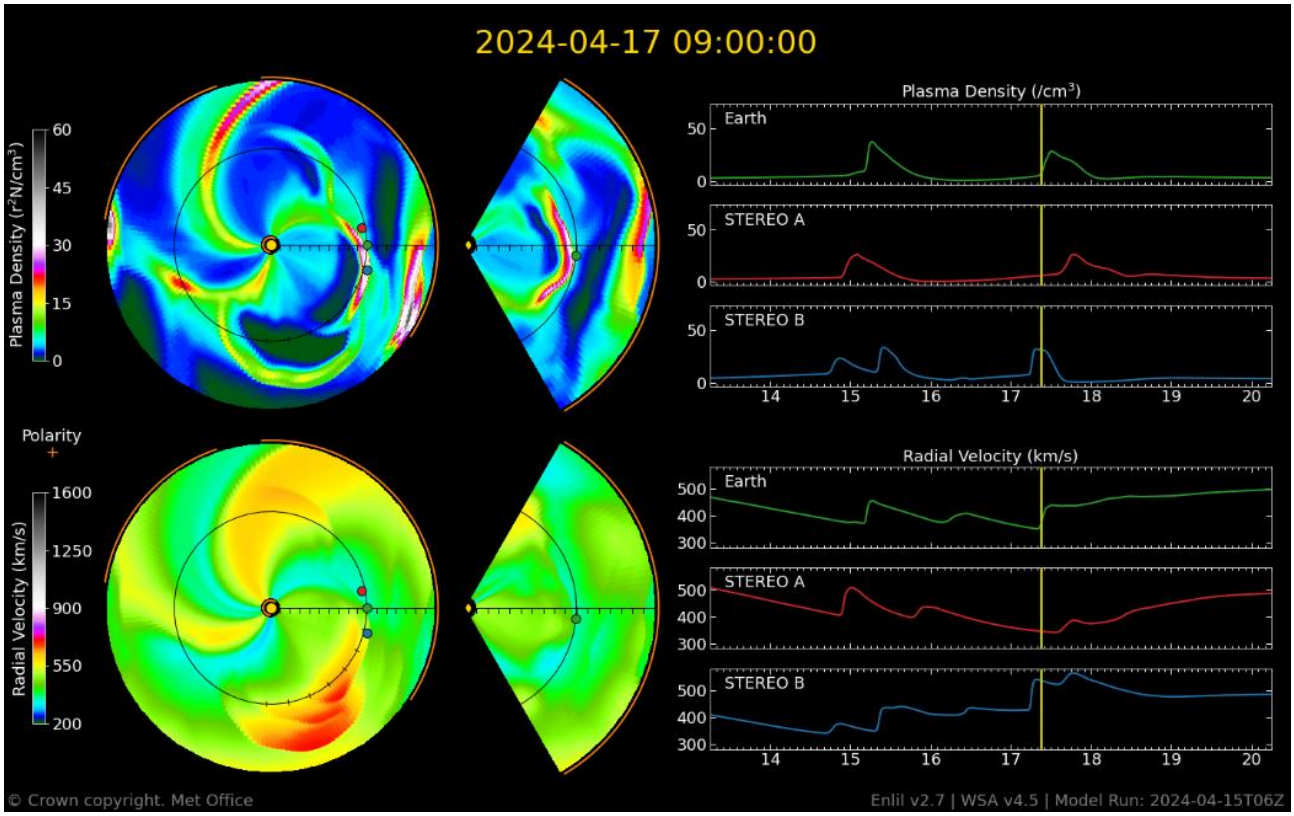

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Radio Blackouts - X-Ray Flares:

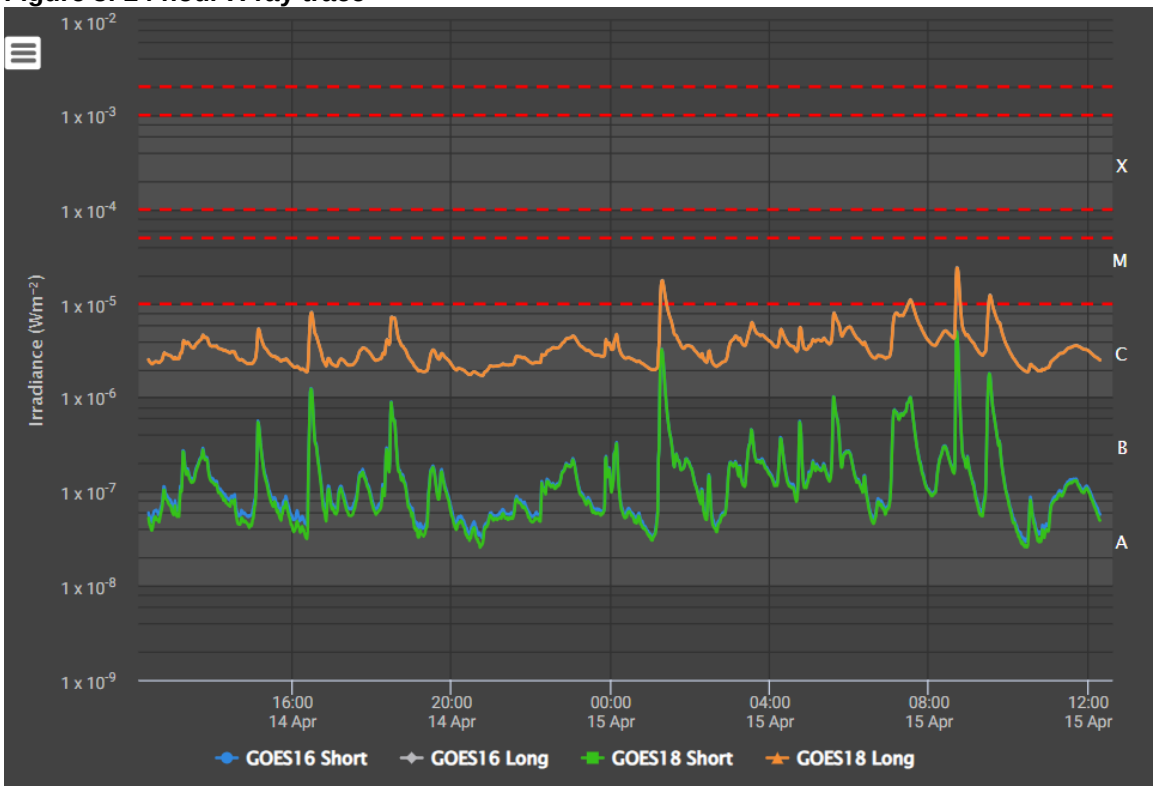
Moderate activity is likely to continue with a slight chance of becoming High. Overall, activity continues on an upward trend with eleven sunspot regions now on the disc, background flux is well within C-class levels and on a rising trend.

At the time of writing, 3 out of the 4 low level M-class flares in the past 24 hours have originated from AR3639 in the northeast. The final flare originated from AR3634 in the northwest.

There are eleven sunspot regions currently visible on the disk. AR3634 in the northwest is the largest spot on the disk and one of the most complex with a beta-gamma-delta configuration evident. AR3639 is another complex spot with a beta-gamma-delta configuration, and evidence of increasing length and area as it rotates into a less oblique viewing angle. AR3637 in the southeast retains its apparent small delta spot. Recently numbered AR3643 in the southeast continues to emerge around the limb, currently with a beta-gamma configuration. All other spots are smaller and simple.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	70	70	70	70
Very Active	R3 to R5 X Class	No	15	15	15	15

Figure 3: 24 hour X-ray trace



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux as observed by GOES18 has persisted at Background. There is a very slight chance of the observed flux increasing in response to any notable flares, primarily from AR3634 with this region moving towards the western limb through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

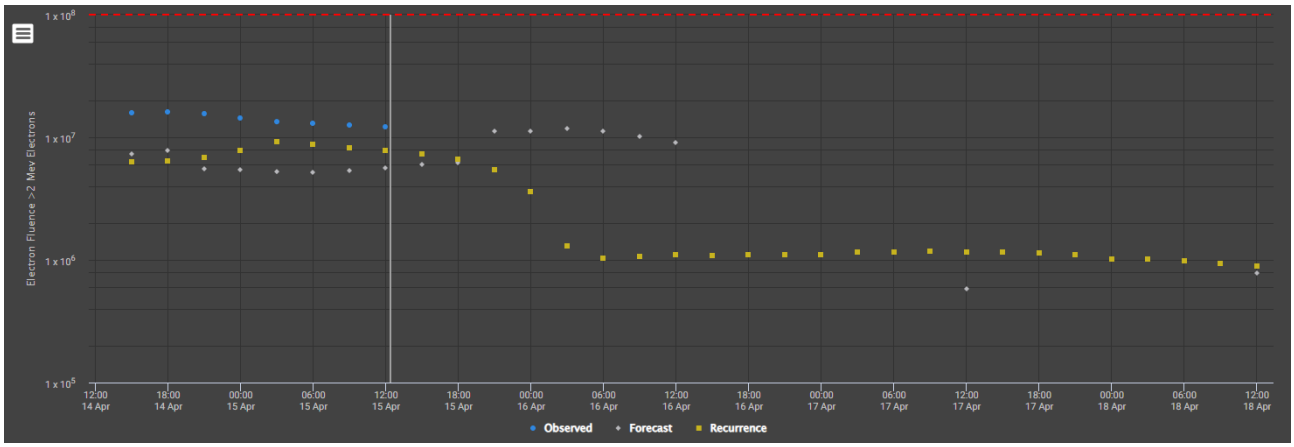
High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 remains at background to moderate levels and is expected to remain so, or reduce given the lack of charging events expected at Earth.

The associated 24 hr electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold, as supported by REFM.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: REFM fluence observations/forecast/recurrance



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